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ISSN 1745-8587



School of Economics, Mathematics and Statistics

BWPEF 0806

**The Impact of Structural Pension  
Reforms on the  
Macroeconomic Performance: An  
Empirical Analysis**

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September 2008

# The Impact of Structural Pension Reforms on the Macroeconomic Performance: An Empirical Analysis

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## Abstract

Whether pension reforms lead to an improvement in macroeconomic performance is a controversial question. Some countries, which have implemented reforms, claim better economic performance while in others a positive result has yet to be seen. This paper explores two aspects of this issue further: Firstly, we provide a comprehensive investigation of the impact of pension reforms on output, capital stock and consumption. Secondly, we attempt to uncover the factors which lead to cross country heterogeneity in the impact of reform. Our results suggest that pension reform led to an improvement in macroeconomic performance. However, there is also evidence to suggest that this improvement was more pronounced in countries with lower public debt, lower age dependency ratio, more developed financial markets and a higher rate of privatisations.

**JEL codes:** E6; H55; C23

**Keywords:** Pension Reform, Dynamic Panels.

Preliminary Version

## 1 Introduction

"International experience with reforms over the past ten years show that there's no single recipe for reform-that countries can mix and match different elements of an effective pension system, based on their own needs. What also emerges is the continued need to reduce poverty, eliminate the risk of rapidly falling living standards, and protecting vulnerable elderly people from economic and social crises."

Robert Holzmann, Director of the World Bank's Social Protection Unit.

Pension reforms in many countries have been a necessity as the problems which have initiated them are real and require immediate action: Population ageing and large budget

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deficits have undermined economic performance and distorted resource allocation. Old public pension systems, too weak to bridge the gap between their obligations and revenues, have drained public budgets and crowded out important funds meant to go to education, health or infrastructure. It has also been argued that the structure of pension systems can distort labour markets, delay further development of financial markets and hinder economic growth. For these reasons many developed and emerging economies have been forced to implement reforms ranging from mild to radical in order to address these issues, despite the political cost.

However, almost two decades after a few Latin American countries started reforming their public pension systems, with Chile as a pioneer, the true results of these reforms are under controversy. A natural question would be whether the reform countries have benefited from those reforms and whether they experienced the anticipated improvements.

Economic theory suggests that countries which adopt pension reforms experience three main effects at the economic level: First, a direct link between contributions and benefits is established, reducing the labor market distortions with which traditional and unfunded programs are considered to be fraught (World Bank, 1994). Second, the evolution of private pension funds contributes to further development of financial markets inducing a more efficient allocation of resources. Regarding the public sector, whole or partial privatization of unsustainable pension funds eliminates budget deficits and improves the creditworthiness of the government.

A number of computational OLG models have been employed to investigate the effects of a shift to a fully funded scheme. Not surprisingly all these models depend highly on initial assumptions such as the method of financing the transition period, credit constraints or perfect capital markets. Those ones that assume tax financed transition from a pay as you go (PAYGO) to a fully funded (FF) pension system, demonstrate output and welfare gains in the new steady state (e.g. Arrau and Schmidt-Hebbel, 1993; Valdés-Prieto and Cifuentes, 1997; Corsetti and Schmidt-Hebbel, 1997). In most theoretical OLG models ageing of population is a crucial assumption which triggers capital flows in open economies. The interested reader may want to refer to Kotlikoff et al. (1997) where privatisation of the public pension system takes place in constant population growth, excluding this way any effects coming from population ageing.

Despite the above economic benefits there are some serious drawbacks that prevent many governments from implementing those reforms. The main one is that the positive impact can be seen in the medium run while the current working generation bears the cost of the reform. Apart from the political cost that a government may face, there is a school of thought that believes that social security should remain under the control of the public sector. Insufficient savings or "inadequate preparation", as Diamond (2004) prefers to name it, is the main argument in favor of public pensions systems. A person may end

up with lower consumption after retirement not because one did not save enough while working but one did not choose a sensible portfolio for long term investment. This can happen for a number of reasons: insufficient information to choose a profitable investment plan, difficulty to obtain insurance against earnings risk for after retirement income, or to plan income flows after retirement are just a few. At the macroeconomic level, financial markets often suffer from great volatility and in some developing countries capital markets may lack of regulatory capacity and bear high investment risk for the individual investor of a limited information set (Orszag and Stiglitz, 1999).

The above factors hold assuming that the individual is a rational optimizing agent. There are also factors that prevent an agent from a rational decision making. These are uncertainty about the life length with longevity to be one of the main issues in actuarial science, reluctance to take into account future illness or disability and the myopic belief in a paternalistic government i.e. the government will care for its citizens. To a great extent this paternalistic element in the function of the government has been largely used to justify mandatory savings.

This paper presents an empirical analysis of the impact of pension reform using a large cross country panel data set. We investigate if pension reforms increase output and consider the factors that may affect the magnitude of this relationship between pension reforms and macroeconomic performance. This paper extends the current existing literature in a number of ways: Firstly, unlike the previous literature we provide a comprehensive investigation on the impact of pension reforms not only on output and its growth but also on capital formation, investment and consumption. Predictions on the impact on these additional variables are usually available on theoretical computational models such as Börsch-Supan *et al.* (2005) and Equipe INGENUE (2001). Empirical estimates on the other hand are less readily available even though they maybe of relevance to policy makers. In addition the existing literature does not provide any guidance on the reasons why some countries experience larger benefits from reforms than others. The second part of the paper considers whether factors such as the age dependency ratio, the level of public debt, the degree of financial deepening, and the number of privatisation may explain cross country heterogeneity in the impact of pension reforms. Our main results suggest the following: Firstly, there is strong evidence that pension reforms increases output, consumption and capital formation in the countries in our panel. Our estimates suggest that the benefits arise gradually. Secondly, we find that these benefits are larger for countries with lower public debt, lower age dependency ratio, higher degree of financial deepening and when pension reforms had been a part of a wider privatisation plan.

The structure of the paper is as follows: Section two describes the main available schemes and proposals for modifications in social security, briefly reviews the recent reforms occurred in different geographical areas and offers an evaluation of those reforms in

accordance with relevant empirical and theoretical literature. Section three provides the hypotheses to be tested, sets the model and describes the methodology. In this section we also describe the methodology we use to test for main contributors on the precedent reforms. The next section describes the data and the sources used in estimations. In section five we discuss our results for the above hypotheses. Section six concludes.

## 2 Pension Reforms around the World and Evaluation

In the last two decades many countries have reformed their social security system by following either parametric (non structural) or structural reforms or a combination of the two. The first type involves improvements of the existing public system to strengthen its financial sustainability in the long run. Measures may involve raising the retirement age, reduction of benefits etc. Structural reforms are more radical and entail replacement of the whole or parts of the public system. A private component is introduced which operates in parallel with the public one and may compete with it. The main characteristics of the private systems are defined contributions while benefits remain uncertain depending on the amount, density and accumulation of contributions, investment returns and other macroeconomic factors.

One of the most influential plans concerning improvements of the existing pension schemes is the three pillar system proposed by the World Bank (1994). According to this study, the first pillar is similar to existing PAYGO public systems managed and funded by the government. Its aim is to prevent poverty and to redistribute income. The second pillar includes mandatory contributions to pension funds under private management. The contributions are percentage of the wage income and aim to income replacement. The second pillar has raised a lot of controversy among academia and governments due to its private, mandatory and defined contribution element <sup>1</sup>. The third pillar has complementary character and involves voluntary contributions to pension funds under private management. Its aim is income replacement.

A popular parametric reform is the implementation of the Notional Defined Contribution (NDC) system. High transitional costs and the complicity of structural reforms have made this model attractive to many economies. In this system, the workers' contributions are defined while benefits depend on the amount contributed and the returns on investment. NDC consists of two elements: The first one resembles the fully funded system in a sense that there are individual "notional" accounts where contributions are defined and will determine individuals pensions. However, the contribution of the current employees are used to pay current pensions and other expenditures. The second element

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<sup>1</sup>For a meticulous critique on World Bank's "Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth", refer to Orszag and Stiglitz, 1999, "Rethinking Pension Reform: Ten Myths about Social Security Systems".

is of redistributive character financed by general taxation. In reality, this is a PAYGO financed scheme with defined contributions <sup>2</sup>. This new approach has been adopted by six countries: Sweden (1994), Italy (1995), Latvia (1996), the Kyrgyz Republic (1997), Poland (1999) and Mongolia (2000).

Of all world regions, reforms in the Latin American countries have received most of the research attention as many of them are radical, innovative and there is sufficient time and data to draw conclusions. Even though each reform has its own features, the reforms in Latin America had a common characteristic: a second fully funded pillar based on defined contributions (DC) to individuals' accounts managed by private companies. These accounts are invested in financial markets and benefits depend on individual contributions and on the returns of pension fund assets (Schmidt-Hebbel, 1999). The first radical reform took place in Chile (1981) where the country moved from a public unfunded and defined contribution system to a funded defined contribution one under private management. The state still plays an important role by supervising and regulating the new system, providing minimum benefits and financing the transition (Holzmann, 1996). After Chile other Latin American countries moved towards privatisation of their pension funds such as Argentina (1994), Uruguay (1996), Bolivia (1997) and Mexico (1997) with Dominican Republic (2003-5) to be the most recent one.

According to Mesa-Lago's (2002) evaluation of pension reforms in Latin America, the effects are not uniform and vary from country to country. First, the amount of insured that moved to private systems is impressively large: 94-97% in Chile, 75% in Argentina, 100% in Bolivia and Mexico. In the last two countries, however, the transfer was not a product of free choice as in other Latin American countries, but it was mandatory. Second, employees' contribution rose significantly while participation from employers fell. This may cause a bigger economic burden for the insured and disincentives for compliance.

Theory predicts that competition among private providers will cut managerial costs and promote efficiency. Yet, there is no certainty that competition in insurance markets will improve: Evidence show that the number of administrators increased initially and then shrunk through mergers. Concentration of affiliates in the three largest administrators has been observed to countries that did not set an upper limit of insured to each administrator. Moreover, the largest providers did not necessarily offer the highest investment returns or the lowest commissions. Administrative costs are not found to be considerably lower due to managerial expenses for marketing advertising and commissions to salespersons.

With regard to the role of pension reforms in economic performance, Holzmann (1997), in his preliminary study about the reforms in Chile, finds a 0.9-2.1 percentage points contribution to the country's high economic growth that occurred in the 80s. In particular,

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<sup>2</sup>Barr N. (2004), Ch.4 "Non-Financial Defined Contribution Pensions: Mapping the Terrain".

his findings demonstrate a strong relationship between pension funds, financial markets development and total factor productivity which are linked to economic growth. Schmidt-Hebbel (1991) also attributes a quarter of country's growth to its 1981 radical pension reform.

While higher capital accumulation and investment find strong evidence in Latin America, empirical results about rise of national savings are contradictory and depend on various factors such as whether transitional fiscal costs have been deducted from private pension savings. When they are taken into account, negative correlation between national savings and pension reform is shown for the first 10 to 15 years. Governments should cautiously set the rise of national savings as a goal from a pension reform. Private savings may go either way as individuals behaviour depends on many factors. On the other hand, public savings may fall if government fully supports the transition<sup>3</sup>. Holzmann (1997) shows a negative relationship between reforms and domestic savings for the period 1981 to 1988 in Chile. After 1989 this relationship becomes positive mainly due to higher returns on capital investment. While the impact on the private saving rate is ambiguous, the public saving rate is clearly higher, as it was required to support the transition.

In Africa, most low income countries have no national pension systems and the elderly counts on young generations to provide but this link is becoming weaker. In the middle income countries of North Africa, pensions systems are rudimental and cover a small percentage of the labour force (Fox and Palmer, 2001). Even though the population is young with a very low dependency ratio compared to other regions (4.7- 6 percent in 1995 according to the World Bank) most of the existing public systems suffer from credibility, corruption and mismanagement<sup>4</sup> leading to large and unfunded liabilities which will have to be balanced by future generations. Many African countries consider the introduction of public or mixed pension systems. Nigeria is the first one to introduce a multi pillar scheme in 2005 and other countries such as South Africa consider similar solutions.

Strong demographic trends and ageing have made reforms necessary for many Asian countries: The 1979 implementation of the one-child-per-family policy in China will boost the ratio of retirees to current workers from 29 percent in 2001 to 55 percent in 2039. In the face of rapid population ageing, China moved to a partly funded three pillar system in a series of reforms during the 90s. The 1st pillar is PAYGO, financed by current revenues descending from the old "iron rice bowl" system which provided social security to state employees until the end of their lives. The 2nd pillar is a mandatory DC system designed to be self financed with individual accounts and the 3rd pillar is a voluntary contributions scheme

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<sup>3</sup>For example the Chilean government experienced high deficits coming from loss of contributors and expenditures for recognition bonds (Holzmann 1997).

<sup>4</sup>For example in Kenya, 100 percent of contributions collected cover administrative costs (Barbone and Sanchez, 1999).



to private insurance companies. Despite its self financed and independent character, the DC system partially works as a PAYGO and the accounts of current employees have been used to cover high existing deficits of the pension system and other public expenditures, in some provinces. In addition, the current pension system covers mostly urban employees while a large part of the rural population is not insured and counts on their families for their welfare after retirement. Kazakhstan adopted a multi pillar system in 1998 while India is implementing a mixed system with mandatory and voluntary contributions for its civil servants, starting in 2004.

Many Emerging Markets in East Europe have implemented considerable structural reforms and have followed the World Bank model (1994), with Czech Republic (1994) and Hungary (1997) to be the first ones. Most OECD countries have not proceeded in radical structural changes. Market oriented economies, such as the UK and the US, are privatizing their pension funds for a long time while others have followed a mixed system similar to the model proposed by the World Bank, such as Australia (1992), Canada (1997) and Denmark (1991).

### 3 Methodology and Estimated Model

The empirical work in this paper is based on the following basic panel data model:

$$Y_{i,t} = a_i + \tau_t + \beta X_{i,t} + \gamma YR_{i,t} + \varepsilon_{i,t} \quad (1)$$

where  $Y_{i,t}$  represents the macroeconomic variables of interest (output, growth, capital, investment and consumption) for country  $i$  at time  $t$ .  $X_{i,t}$  is the set of relevant control variables which are described further in each subsection below.  $YR_{i,t}$  denotes the impact of the reform on the dependent variable and is proxied by the number of years that have passed after the first structural reform in each country. The coefficient  $\gamma$  is the main coefficient of interest. In particular, a negative sign on  $\gamma$  would indicate that pension reforms would have a negative effect on the above macroeconomic variables. There is, however, no a priori reason to believe that any positive or negative reform comes about immediately. For example, theoretical models (Schmidt-Hebbel 1997, Equipe Ingénue 2001) would predict non linear dynamics. We capture this possibility in a simple manner by including a third order polynomial of  $YR_{i,t}$  in our regressions.

In estimating equation (1) a number of econometric issues have to be taken into account. Firstly, in order to deal with cross sectional heterogeneity we introduce cross sectional fixed effects  $a_i$  and to capture time specific heterogeneity we include time specific fixed effects  $\tau_t$ . The RHS variables are potentially endogenous in this model. To minimise the possible impact of endogeneity we only include lagged variables on the RHS of the equation (1).

A natural choice in this scenario is the GMM estimator introduced by Arellano and Bond (1991). However the relatively small cross sectional dimension of our panel makes the implementation of the GMM estimator potentially difficult. More precisely, the efficiency of GMM estimates is low in panels with a small  $N$  (see Judson and Owen 1997). Therefore we estimate our regression models using fixed effects estimator but also report results from GMM regressions.

Another potential concern is the fact that the impact of pension reform (and the other control variables) may be different across countries. This is especially true in our data set that includes both developed and developing countries with different economic structure. The second part of the paper examines how government's fiscal behaviour and financial structure contribute to the positive or negative impact on growth we find in section 5.

To test this additional question we augment equation (1) as follows:

$$Y_{i,t} = a_i + \tau_t + \beta X_{i,t} + \gamma YR_{i,t} + \delta (YR_{i,t} \times F_{i,t}) + \varepsilon_{i,t} \quad (2)$$

The extra term  $YR_{i,t} \times F_{i,t}$  represents an interaction between the years after pension reform and a set of factors that may have an impact on the magnitude of the benefit of pension reforms. In other words, the coefficient  $\delta$  captures how  $F_{i,t}$  alters the impact of pension reform. The variables  $F_{i,t}$  include public debt, age dependency and measures of financial market development.

## 4 Data and Choice of Variables

This empirical analysis, uses panel data on 27 countries, of which 7 are developed economies and 20 are Emerging Markets (EMEs). A list of countries is provided in Table 1 together with the dates for the start of pension reforms in each country. These dates are crucial in determining our pension reform variable  $YR$ . The classification of these countries as reform ones are based on the criteria that they have moved a part or whole of their PAYGO system towards a funded one, with private insurance (voluntary or mandatory) holding a significant role on benefits. This means that reformed PAYGO systems with a new mandatory and private fully funded component are also included since they have undergone through major reform. However, in this study we do not include NDC systems even if in the theory are defined contributions systems and fully funded, many of them operate in a PAYGO basis under public management, trying to cover existing social security deficits. There are alternative ways of carrying out this classification. For example, the International Federation of Pension Funds Administrators (FIAP) considers reform countries those that have introduced individual capitalisation of savings in a compulsory basis. FIAP's classification includes also the NDC countries.

The years of the initial reforms, showed in Table 1, are collected from various sources (Mesa-Lago, 2002; James, 2005; FIAP, 2007; Hu, 2005; Schwarz, Demirguc-Kunt, 1999; Capretta 2007, and various papers from International Social Security Review Vols 54, 55 and 56, 2001, 2002, 2003) and are based on first steps towards fully funded pension systems. The dates are cross checked from various sources and we used the ones met in most sources. Differences in dates can be observed due to different dates of voting and implementation of a reforming law. Our classification may not capture the homogeneity in the degree of reform that each country has undergone. In several of them both public and private pension systems co exist and employees participate in both or interchange between the two: In Colombia, for example, workers have to decide between a downsized PAYGO or a private account but they can revise their decision after three years while in Argentina this is not possible. In Uruguay, poor workers are included automatically in the public system while the high earners can contribute in both systems. In other countries the pension reform is an ongoing process, such as the UK, and more than one dates can be considered as a reform initiator. We choose the dates where laws towards private fully funded systems have been adopted. Overall, it is very difficult to capture these differences across countries. Instead, in our framework, we attempt to capture the overall impact of reform.

A list of control variables  $X_{i,t}$  is shown in Table 2 while Table 3 provides basic descriptive statistics of the data set. Most of these data are taken from World Development Indicators (2006), OECD Economic Outlook (2007) and IFS Country Tables (2007). Financial Markets variables are obtained from the financial structure dataset of T. Beck and E. Al-Hussainy, World Bank, (2007) and from Global Financial Data. Gross National Disposable Income data for Latin American countries are taken from the Statistical yearbook for Latin America and the Caribbean (2006), Economic Commission for Latin America (ECLAC). The data for central government's total debt come from the paper of Danny Jaimovich, Ugo Panizza (2006). Privatisation's data come from a variety of sources: From 1988 to 1999 data come from FDI.net while from 2000 to 2005 data are aggregated from World Bank's Privatisation Database for the EME's and from OECD's Financial Trends for the developed economies. In addition we calculate GDP and real exchange rate volatility by using GARCH (1,1) models. The dataset is annual and the maximum span is 1960-2006.

We carry out cleaning in the following manner: we visually examine each country's series checking specifically for large outliers and typos. We either remove anomalous observations or replace them with interpolated values. Table 4 provides an analysis of the stationarity properties of the data set. In particular, we carry out two panel unit root tests for each variable, both in levels and in differences. We use the Levin, Lin & Chu (LLC) test which includes Fixed Effects and Im, Pesaran and Shin (IPS) ADF tests that allows for heterogeneity across countries.

Table 3 suggests a mixed picture across the range of explanatory variables. We find evidence of stationarity for variables such as GDPPC, real interest rate, inflation, liquidity

to GDP ratio etc. while it is difficult to reject the null hypothesis for some macroeconomic variables such as GDP per capita, Disposable Income, Capital Stock. This mixed picture complicates attempts to conduct cointegration analysis of eq. (1). Therefore we do not use cointegration models in the empirical analysis below.

## 5 Empirical Results

The empirical result of the paper are presented in section 5. Section 5.1 attempts to answer the first question of the paper set out in the introduction: it investigates the impact of pension reform on output per capita, capital stock formation, consumption their growth rates. Section 5.2 extends this analysis further by considering different factors that can reinforce the estimated effects of pension reforms.

### 5.1 Impact of Pension Reforms

#### 5.1.1 on Output per capita

The question of interest in this section is whether pension reforms have contributed to a higher level of output per capita and whether have enhanced growth. The two way error component model is written as follows:

$$\text{LogGDPPC}_{i,t} = \alpha_i + \tau_t + \beta \text{Log}(X_{i,t-1}) + \gamma \Delta \text{Log}(Z_{i,t-1}) + \delta YR_{i,t} + \varepsilon_{i,t} \quad (3)$$

where *GDPPC* is the GDP per capita. The explanatory variables reflect macroeconomic conditions as captured by the real interest rate (*RealInt*)<sup>5</sup>, inflation ( $\Delta \text{CPI}$ ) and trade openness (*Trade*). Trade openness is measured by the sum of exports and imports of goods and services divided by the GDP. Financial development is proxied by domestic credit provided to the private sector (*DomCred*) and the liquid liabilities (*Liq*) both as a proportion of GDP. The role of the stock market is introduced by the ratio of stock market total value traded to GDP (*SMTrade*) and the stock capitalisation to GDP (*SMCap*)<sup>6</sup>. We take demographics into account by including the age dependency ratio (*AgeDep*) for each country. As discussed above *YR* is meant to reflect the impact of pension reforms in this model (after controlling for the other variables discussed above). As in Packard (2001), we consider a third order polynomial in this variable in order to capture possible non linearities in this relationship.

The benchmark results are reported in the first column of Table 5. The Hausman specification tests suggest that the FE model is preferred to the Random Effects (RE) specification. In addition, we strongly reject the hypothesis that the time and cross section

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<sup>5</sup>Series for the real interest rate are estimated by the World Bank.

<sup>6</sup>We also found qualitatively similar results when using the Stock Market Turnover Ratio.

effects are zero. In terms of the control variables we find a negative and significant coefficient for the real interest rate. Trade openness and the stock market capitalisation which proxies financial markets' developments have both positive and significant coefficients, in accordance with economic theory.

As in Packard (2001) we find that a third order polynomial in  $YR$  fits the data well with statistically significant coefficients for all three terms. ( $YR^2$  and  $YR^3$  are jointly significant with the Wald test statistic (p-value) equal to 6.482 (0.0018). The signs suggest a J curve type effect of the reforms on the level of output per capita. In other words there is a negative initial impact of pension reforms which becomes positive as the years after reform ( $YR$ ) increase. This simple point is illustrated in Figure 1 which shows a scatterplot of this relationship for each country<sup>7</sup>. It is interesting to note that it takes about 10 years for the positive impact of pension reform to appear in our model (e.g. Chile, Australia, UK<sup>8</sup>).

The second and the third column of Table 5 split our panel into seven industrialised and 20 EMEs countries in order to investigate the presence of cross region heterogeneity. For the emerging markets the coefficient on  $YR$  and  $YR^2$  is negative (with the latter statistically significant) possibly suggesting a more prolonged initial negative effect of the reform. The results for the industrialised countries are different: The coefficient on  $YR$  is large, positive and significant indicating that pension reforms had a positive impact on  $GDPPC$  on these countries. One potential explanation for these regional differences is that most reforms in industrialised countries were smooth and gradual while the EMEs reforms, (especially in Latin America) were more radical and the implementation period was shorter<sup>9</sup>. These split sample results provide evidence of heterogeneity in the impact of pension reforms across countries. We return to this issue in section 5.2.

In Table 6 we re-estimate our main specification by using i) OLS fixed effect model in first differences and ii) Arellano and Bond GMM. The aim is to obtain estimates which are less susceptible to endogeneity of the RHS variables. In addition, these alternative models may indicate whether the relationships discussed above hold in growth rates. There are two issues surrounding the GMM estimates. Firstly, the relatively small cross section in

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<sup>7</sup>The figure plots  $YR$  against the fitted values of  $\log GDPPC$  as predicted by our estimated equation.

<sup>8</sup>The figure also shows that the Netherlands is an outlier in the sense that it displays a negative effect in the long run. This may explain why we get a small negative coefficient for  $YR^3$ . In order to explore this further we re estimate the model leaving Netherlands out of the panel. The aim is to check if there is substantial change in the results in this case. Table 13 presents coefficient estimates from the benchmark model using this truncated panel. The results show that the pattern of coefficients on  $YR$  and  $YR^2$  is similar to the benchmark case. In particular, the coefficient on  $YR$  is small and insignificant while the coefficient on  $YR^2$  is significant and positive indicating that the positive effect of pension reform manifests itself gradually.

<sup>9</sup>Note, however, that the relatively small cross sectional dimension of the industrialised group could be another reason behind the different results.

our panel possibly makes the GMM results less robust. Secondly, the GMM estimator proceeds by eliminating the FE from equation (3) via first differencing. This implies that the GMM equation includes  $\Delta YR$  therefore the interpretation of the coefficient of this variable is different in this model.

The first two columns in Table 6 present the results of the OLS FE model in differences and the GMM (default) model. The GMM models use a common instrument set consisting of the second lag of the level of the RHS variables and the second to the fourth lag of  $GDPPC$ . Note that the Sargan test fails to reject the validity of the instruments. Furthermore we find no evidence of second order serial correlation. The benchmark regression in the first and second columns of the Table 6 suggest that the growth of output ( $\Delta GDPPC$ ) has increased after the reform. The higher order terms are insignificant in most specifications. These results are robust to the inclusion of a lagged dependent variable (column 3). Overall, the results are supportive of a positive impact of pension reform on  $GDPPC$  in growth rates and suggest that the estimates in Table 5 are not simply picking up the trend in  $GDPPC$ <sup>10</sup>.

The final sensitivity check concerns possible multicollinearity between  $YR$  and the stock market variables. That is under a scenario where pension reform affects  $GDPPC$  solely through its impact on financial markets, including both  $YR$  and  $SMTrade$  and  $SMCap$  on the RHS of equation (3) may lead to imprecise estimates of the impact of pension reform. On the other hand, a more complex interaction between financial market development and pension reform is also a possibility. The last column in Table 6 simply repeats the estimation of our benchmark model excluding the stock market variables. The coefficients on  $YR$  still show the same pattern suggesting a negative initial impact and a positive eventual effect.

### 5.1.2 on Capital Formation and Investment

Some theoretical models suggest that a switch to fully funded systems will increase capital levels and investment. This can happen in two ways: Firstly, capital accumulation and investment can increase through financial deepening accompanying pension reform. Secondly, it may occur directly through higher national savings. Feldstein and Samwick (1996) in a study for the US case, estimate that mandatory savings together with decrease

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<sup>10</sup>We explore the possibility that  $YR$  maybe influenced by country specific variations in the LHS variable (due to differences in the business cycle) by re estimating our main specification in Table 5 using country specific time effects. An F test of joint significance of these time effects has a p value of 0.782 suggesting that they are not important. In addition the pattern of the coefficients on  $YR, YR^2, YR^3$  is very similar to the pattern reported in Table 5 with the positive impact of pension reform estimated to be gradual. See Appendix 2 for the coefficient estimates.

in distortionary income or payroll taxes will increase US capital stock by 12% in 25 years after the full implementation of the new system. In theory agents may reduce their private savings in order to contribute to the mandatory individual accounts and the overall effect may be zero as Orszag and Stiglitz, (1999) believe. However most agents, according to Feldstein and Samwick (1996), have insufficient savings so the mandatory contributions will represent additional savings which in turn will increase national savings and capital accumulation<sup>11</sup>. In theory, additional savings which are not distributed immediately as pensions but are invested in the stock market must increase the level of investment and capital accumulation. In this section we examine whether capital accumulation and investment have been affected in the reforming countries.

As in the previous section we investigate the relationship between pension reform and capital accumulation via the following simple model:

$$\text{LogKPC}_{i,t} = \alpha_i + \tau_t + \beta \text{Log}(X_{i,t-1}) + \gamma \Delta \text{Log}(Z_{i,t-1}) + \delta YR_{i,t} + \varepsilon_{i,t} \quad (4)$$

where  $KPC$  denotes the capital stock scaled by population.  $X_{i,t}$  and  $Z_{i,t}$  include variables that control for future profitability (stock market total value traded to GDP ( $SMTrade$ ), trade openness ( $Trade$ ), the real interest rate ( $RealInt$ ) and economic uncertainty (GDP and real exchange rate variances ( $GDPVar$  and  $RealERVar$  respectively)). This choice reflects the variables typically included in aggregate investment equations. As in equation (3)  $YR$  denotes the number of years after the reform. Again we consider a third order polynomial in order to capture non linearities in the relationship.

The first column of Table 7 presents the results from the benchmark model. The Hausman test indicates that the FE model is more appropriate. We find that  $KPC$  is positively affected by  $SMTrade$  and  $Trade$  while our measure of uncertainty  $GDPVar$  has significant negative impact. The impact of  $YR$  on capital is similar to its effect on  $GDPPC$ . In particular,  $YR^2$  has a significant and positive coefficient. In contrast the coefficient on  $YR$  is insignificantly different from zero. This suggest that any positive impact of pension reform on  $KPC$  does not materialise immediately possibly suggesting a similar pattern to the J curve effect found in the previous section. This is illustrated in Figure 2 which plots  $YR$  against the value of  $KPC$  predicted by the years to reform. The second and the third columns split the sample into EMEs and industrialized countries. Our estimates are generally consistent with the results for  $GDPPC$ . More specifically, we find some evidence of a positive impact of the reform for industrialized countries, while this beneficial effect appears to be absent from the EMEs sample.

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<sup>11</sup> Another key difference between the two approaches is the different rate of return of PAYGO system and private funds. Supporters of privatization argue that individual accounts invested on the stock market will carry much higher return than a PAYGO system. The return on a PAYGO mature system, which according to Samuelson (1958) is equal to the sum of labour force and productivity growth, is not expected to be very high in an ageing population economy.

Note that we supplement this benchmark model with GMM regressions carried out using the following first differenced model with investment ( $\Delta \text{LogKPC}$ ) as the dependent variable:

$$\Delta \text{LogKPC}_{i,t} = \alpha_i + \tau_t + \beta \Delta \text{Log}(Z_{i,t-1}) + \delta \Delta YR_{i,t} + \varepsilon_{i,t} \quad (5)$$

Table 8 presents estimates of the equation (5). In order to tackle endogeneity we re-estimate our model by using first order differences with FE and GMM similar to the previous section. The results in Table 8 show no empirical evidence for significant impact of pension reforms on investment by regressing the default model in FE and in GMM. When we include the lagged dependent variable in the control variables (3rd column) we find a positive significant effect which takes place after some years from the implementation of the reform ( $YR^2$ ). This is consistent with the findings for capital accumulation which suggest a rise in the medium run.

### 5.1.3 on Consumption

In this section we investigate whether pension reforms have influenced aggregate per capita consumption. Planned consumption depends on total wealth, human and non human (Deaton, 1992). Non human wealth can include financial wealth (assets, bonds, life insurance, pension assets, etc.) and non financial, tangible wealth such as housing. Assets that can be liquidated easier, affect consumption more when consumers face credit constraints, while in developed financial markets both types of assets have significant impact. According to the permanent income hypothesis, an agent decides his consumption in each period according to his life time resources (income). This theory explains why temporary fiscal policies may have a smaller effect than permanent ones: a decrease of the payroll tax due to privatisation of the pension system is a permanent measure and will influence the permanent income. The same holds for structural pension reforms.

Caroll and Summers (1991) found evidence against the permanent income hypothesis by showing a strong relationship between consumption and income growth rates and Wolff (1998) showed that, given most households attain little wealth, consumption paths track approximately income paths. When pension reforms are matched with tax cuts they can affect current income as well. According to the Random Walk Hypothesis which accounts for uncertainty, any change in consumption is unpredictable and the only driving force is the real interest rate (Hall, 1978). This comes from the discount factor in the intertemporal optimisation of the consumption path. However, Hall found significant impact of lagged stock price movements. A vast literature has developed beyond these two main approaches which examines additional factors: liquidity constraints, personal disposable income and financial wealth (for example, see Barrell, Byrne and Dury, 2003).

To examine whether reforms in the public pension system have an impact on aggregate per capita consumption we estimate the following model:



$$\text{LogCPC}_{i,t} = \alpha_i + \tau_t + \beta \text{Log}(X_{i,t-1}) + \gamma \Delta \text{Log}(Z_{i,t-1}) + \delta YR_{i,t} + \varepsilon_{i,t} \quad (6)$$

*CPC* stands for consumption per capita, and  $X_{i,t}$  is the vector of the control variables. The control variables are chosen to account for the different theoretical determinants of consumption mentioned above. In particular we use the real interest rate (*RealInt*) in accordance with the arguments in Hall (1978). As in Carroll and Summers (1991) and others we include a measure of current real household disposable income (*DispInc*). The stock market index (relative to GDP) is included to capture the impact of financial wealth on consumption. We also include a measure of liquidity (*Liq*) to account for financial markets' liberalisation and hence possible changes in the degree of liquidity constraints.

The first column of Table 9 shows the benchmark estimates of equation using fixed effect estimator. We find that real interest rate has a significant negative impact on consumption. Furthermore, the coefficient on disposable income and the stock market index are positive and significant. The estimated coefficient on *YR* is very small but statistically significant suggesting that the impact of pension reform on consumption is marginally positive in our sample. This provides tentative evidence that economic agents may have increased their consumption in anticipation of higher returns from private pension funds in the future. The second and the third column of the table show that this positive impact on consumption may be limited to industrialised countries. The estimated coefficient on *YR* in industrialised countries sample is significant while the estimate for the same coefficient in the EMEs is insignificant. Note, however, that the precision of this result for industrialised countries may be in doubt because of the small cross section.

Table 10 tests the robustness of these results by re estimating the equation (6) in first differences using fixed effects and GMM. The first two columns show that the positive effect of pension reform is still evident when a) estimation is carried out in first differences and b) the Arellano and Bond GMM estimate is used. The final column of the table adds a lag of consumption to the RHS of the equation. In this case there is less evidence for the importance of pension reform. Although the coefficient is still positive it is too imprecisely estimated to make a strong case about an important effect of pension reform.

## 5.2 Factors that reinforce the impact of pension reforms

In this section we investigate the factors that affect the magnitude of the benefits from pension reforms, as measured by their effect on output (see equation (3)). We estimate specifications of the following type:

$$\text{LogGDPPC}_{i,t} = \alpha_i + \tau_t + \beta \text{Log}(X_{i,t-1}) + \gamma \Delta \text{Log}(Z_{i,t-1}) + \delta YR_{i,t} + \zeta (YR_{i,t} \times F_{i,t}) + \varepsilon_{i,t} \quad (7)$$

The basic RHS control variables are the same as in equation (2). As discussed above we now include additional interaction terms ( $YR_{i,t} \times F_{i,t}$ ) to capture the factors that influence the magnitude of pension reforms. We assume that the variables that can potentially affect the relationship between pension reforms and *GDP**PC* include public debt to GDP ratio, age dependency ratio, number of privatisations and stock market capitalisation.

We interact public debt as a percentage of GDP with the reform variables to account for the argument in Schmidt-Hebbel (1999) among others, that the government needs resources to support pension reforms and the generations in transition, who may bear the burden. Here we formally investigate whether a lower level of public debt enables higher positive impact of pension reform.

We explore the impact of the population structure by including age dependency as an additional variable in  $F_{i,t}$ . Several countries have combined structural pension reforms with an increase in the retirement age, therefore a decrease in age dependency ratio. It was common policy for many Latin American countries to try to downsize the implicit debt of their PAYGO system before moving to a new FF system by either increasing pension contributions or increasing retirement age. Retirement age was increased in Chile, Argentina and Uruguay while the eligibility period for retirement was increased in Argentina and El Salvador. Our aim is to investigate whether a fall in age dependency can affect the impact of structural pension reforms. For example, in a country with high number of retirees the working population during the reform will be burdened more by higher taxes or cuts in government expenditure. This could potentially reduce benefits accruing from pension reforms.

The development and deepening of financial markets can also positively influence pension reforms and enhance their results. Moreover, the privatisation of public pension funds is closely linked with the returns from financial markets. For these reasons we include interaction terms with the stock capitalisation variable.

In many emerging markets, especially the ones which carried out pension reforms without the immense problem of population ageing, the pension reform was a large component of a new economic development approach which aimed at decentralisation of economic decisions to private agents, privatisation of public enterprises and market liberalisation (Schmidt-Hebbel, 1999). Privatisation of public companies led to lower government expenditure. For example, many East European countries sold public organisations after their transition from communist to market oriented economies. We aim to examine whether reforms which took place in a general privatisation environment were more successful in terms of output. Therefore, we interact the number of privatisations' transactions (*PrivatNo*) with the variables of the reforms (*YR*).

The main results are presented in Table 11. The first column in the Table 11 presents results from our most general specification (which encompasses all macroeconomic and

financial variables and allows interactions with all candidate variables that may facilitate pension reforms). As in Table 5 the coefficients on  $YR, YR^2, YR^3$  follow a pattern that suggests a J curve type effect. The estimated coefficient on public debt is negative and significant. The coefficient on the interaction term  $\ln Debt \times YR$ , is positive and significant while the impact of  $\ln Debt \times YR^2$  is negative. Note that these signs are opposite to those on  $YR$  and  $YR^2$ . In total, this implies that high debt levels dampen benefits arising from the reforms. This result is best illustrated in Figure 3a where the impact of pension reforms on  $GDPPC$  is shown for different levels of public debt for two countries. The two countries depicted here are characterised by high and low public debt respectively. In both cases a positive effect from the reforms is observed, which becomes larger for higher values of  $YR$ . However, in the case of the highly indebted country, this positive impact becomes smaller as debt increases<sup>12</sup>.

Column 1 shows statistically significant estimates for  $\ln AgeDep \times YR$ . As Figure 3b illustrates, this result implies that high age dependency may reduce the positive impact of pensions reforms. In particular, it makes the impact more non linear with a noticeable negative effect in the short run. This can be seen from the left panel of Figure 3b which shows the relationship between  $YR$  and  $GDPPC$  for different levels of age dependency in Costa Rica<sup>13</sup>.

Stock Market capitalisation is also found to affect the impact of pension reforms positively. Nevertheless, this result is evident only when the interactions involving this variable are considered separately. Figure 3c illustrates the role of stock market capitalisation in our main specification (column 1) while Figure 4 shows the results for the specification in column 3. It is clear that the effect of stock market capitalisation is evident only in the second case where higher value of this variable increases the benefit of pension reform.

In the last column of Table 11 we interact the number of privatisation with the pension reform variables. In many East European countries, privatisations of the public pension system was a part of a general privatisation plan and contraction of the government size. For example, the Bulgarian pension reforms initiated in 2000, after a big wave of public sector privatisations. We do not include privatisation in our main model because the lack of data for some countries significantly decreases the number of cross sections. In the last column we estimate a separate regression for 16 countries. The result suggests that public pension reforms accompanied by privatisations of other public organisations performed was more beneficial in terms of increasing output. This result is indicated by the significant positive coefficient on  $\ln PrivatNo \times YR$ . The last panel of Figure 3 illustrates this for two countries with low and high number of privatisations respectively.

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<sup>12</sup>The results are the same if debt is considered separately in our model (column 2 of Table 11).

<sup>13</sup>As in the case of public debt, qualitatively the results remain the same in column 3 of Table 11.

## 6 Conclusions

This paper examines the macroeconomic effects of structural reforms of the public pension system. In particular, it examines the consequences of major reforms on public PAYGO systems towards fully funded ones.

The findings show that structural pension reforms have a J curve type effect on output per capita. In other words we estimate the immediate impact on output per capita to be negative with the benefits of the reforms appearing after about 10 years. We find qualitatively similar results for the impact on the capital stock. There is some weak evidence that consumption (per capita) increases slightly after the reform. Our estimates also indicate that the growth rate of these variables is positively affected by the introduction of the funded system.

The second part of this study focuses on the factors that cause the impact of funded systems to vary across countries. We examine the role of public debt ratio to GDP, the age dependency ratio, the capitalisation ratio of financial markets and the number of privatisation on reforms. by interacting those factors with the proxied variable for the pension reforms. Our results suggest that sound fiscal policy in the reform environment is an important contributing factor to the resulting benefit on output per capita. More specifically, our estimates show that highly (public) indebted countries respond less to this kind of reforms in terms of output change. Therefore, reduction in the levels of public debt and increase of public savings help the economy to adapt better to these changes. Furthermore, countries which followed public expenditure cuts by proceeding to privatisations of public companies appear to have benefited more from the reforms. Reforms are also found to perform better in economies with low age dependency ratio and developed financial markets.

The empirical work in this paper is based on different estimators: namely fixed effects and Arellano and Bond (1986) GMM. In general, the main results are similar across these two estimators. Our preferred model, however, is based on the fixed effects estimator. This is mainly because in a panel with a small cross sectional dimension GMM appears to have a large variance with its results largely dependent on the instrument set chosen. Given that the time series in the panel is relatively large any biases associated with fixed effects are likely to be small (see Nickel, 1981).

The analysis in this paper does not examine the effects of the system change on labour markets or on the controversial saving rate. It does however find a positive impact of reforms on capital formation and investment in the countries of question. Future research will consider the change in returns of pension funds and their impact on growth.

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## 7 Appendix I

In this Appendix we test the robustness of these results of eq.(2) by adopting a cross sectional approach. More specifically we estimate the following expression:

$$ImpactPR_i = \alpha_i + \beta Ln(X_i) + \varepsilon_i \quad (8)$$

The dependent variable is derived using the following expression:  $ImpactPR = \hat{\alpha}YR_i + \hat{\beta}YR_i^2 + \hat{\gamma}YR_i^3$ . The coefficients  $\hat{\alpha}, \hat{\beta}, \hat{\gamma}$  are obtained by estimating equation (3) separately for each country in our panel. The number of observations for each country is generally small. Therefore, we follow a general to specific procedure in selecting a parsimonious specification for each country. That is we start by using all the control variables in equation (3) and then we eliminate either highly insignificant variables or those which lack sufficient number of observations<sup>14</sup>. The expression for  $ImpactPR$  provides an estimate of the effect of pension reform that varies with YR. For the cross section regressions we consider the 5 year average and the 5 year sum of the series where both are calculated after the beginning of the reform.

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<sup>14</sup>The individual regressions are available on request.

The RHS variables include the average growth of public debt, the average number of privatisations, the average age dependency ratio and the average stock market capitalisation. The averages for public debt growth is calculated for the 5 years proceeding reform. This is done to investigate if a rise of public savings before the pension reform affected the future economic performance of the reform. Similarly, the averages for age dependency and stock market capitalisation are taken over the same horizon <sup>15</sup>.

Table 12 presents the estimates of our main regressions. The specifications are estimated by using weighted least squares where we weight each observation by the reciprocal of the number of observations in the underlying country specific time series regression <sup>16</sup>. We start with a very simple specification with one explanatory variable and we proceed by adding the other control variables. The left panel uses the 5 year averages of the *ImpactPR* as the dependent variable and the right panel the 5 year sum. The first column of Table 12 includes only public debt growth. The coefficient on public debt growth is negative and significant, suggesting that higher debt growth before the pension reform had a negative effect on the subsequent impact on *GDPPC*. The second and the 3rd column show that the number of privatisations and age dependency have the expected signs but are insignificant at 5% level. The final specification includes average stock market capitalisation. The negative coefficient on this variable is difficult to justify from a theoretical perspective. The results are very similar for the 5 year sum of the *ImpactPR*. That is they provide fairly strong evidence of a negative relationship between public debt and the impact of pension reforms and some tentative evidence of the importance of age dependency and privatisation.

## 8 Appendix II

This appendix describes results for versions of our main specification in Section 5.1 which include country specific time effects. The estimates, as shown in Tables 14a and 14b, suggest two main results: First, the coefficient on YR in this extended model generally follows the same pattern as the benchmark specification. In other words, the estimates suggest a positive impact of YR on each of the dependent variables. The second conclusion is that the country specific time effects are generally non significant except for the final regression based on the growth rate of consumption. Note that the conclusions on the coefficients on YR are not altered.

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<sup>15</sup>The averages are taken 4 years before the reform and include the year of the reform. For countries where these data are unavailable we take the averages over the first 5 available years as long as they include the year of the reform.

<sup>16</sup>This is done to take into account the possible imprecision in estimating the dependent variable in small samples.



TABLE 1: Reformed Countries and Year of the Pension Reform

<i>Developed E.</i>		<i>EME's</i>			
Australia	1992	Argentina	1994	El Salvador	1998
Canada	1997	Bolivia	1997	Hungary	1997
Denmark	1991	Bulgaria	2000	Hong Kong	2000
Netherlands	1960	Chile	1981	Israel	1995
Switzerland	1995	China	1997	Kazakhstan	1998
UK	1988	Colombia	1994	Mexico	1995
US	1981	Costa Rica	2001	Nicaragua	2002
		Croatia	2002	Peru	1993
		Czech Republic	1994	Romania	2001
		Dominican Rep.	2003	Uruguay	1996

*Note:* The dates of reforms for the Latin American countries have been obtained by C. Mesa-Lago (2002), E. James (2005), for East European countries by Müller, K. (2001), Potuček (2001) and FIAP (2007). For most of the developed economies we found historical data in Hu (2005), FIAP (2007) and Capretta (2007).

Netherlands are included since they have a large fully funded occupational pension system. Their basic public pension system has not been structurally reformed since its introduction in the late 50s apart from legislation aiming to decrease its generosity and the early retirement incentives (van Riel, 2002, Capretta, 2007).

The UK pension policy has undergone constant adjustment since the mid-1970s, “in part because the British parliamentary system allows the dominant political party of the day to rather easily re-orient the pension system in its own philosophical direction” (Capretta, 2007). During the 80s the pension reforms initiated by the conservative party aimed at further expansion of the funded private pension provision as a substitute for reduced public benefits. In this table we consider the reforms initiated by the Social Security Act of 1986 because a large amount of employees were encouraged to abandon the State Earnings Related Pension Scheme (SERPS) and to switch to private pension schemes. These reforms received a lot of criticism due to the “miss selling” scandal in December 1993 (for more information about the UK pension system see Blake, 2003).

TABLE 2: Variables' Definition, Source and Observation Period

<i><b>Variable</b></i>	<i><b>Definition</b></i>	<i><b>Source</b></i>	<i><b>Observ. Period</b></i>
GDPPC	GDP per capita (constant 2000 US\$)	WDI (2006)	1960-2005
Reallnt	Real Interest Rate (%)	WDI (2006)	1960-2005
DomCred	Domestic Credit to Private Sector (% of GDP)	WDI (2006)	1960-2005
Liq	Liquid Liabilities to GDP	BDL (2006)	1960-2005
KPC	Gross capital formation per capita (constant 2000 US\$)	WDI (2006)	1960-2005
CPC	Household final consumption expend. per capita (constant 2000 US\$)	WDI (2006)	1960-2005
AgeDep	Age Dependency Ratio (dependents to working-age population.)	WDI (2006)	1960-2005
CPI	Consumer Price Index (2000=100)	WDI (2006)	1960-2005
SMCap	Stock Market Capitalisation to GDP	BDL (2006)	1976-2005
SMTrade	Stock Market Total Value Traded to GDP	BDL (2006)	1975-2005
SMTurn	Stock Market Turnover Ratio	WDI (2006)	1960-2005
SMInd	Stock Market Index	GFD (2007)	1960-2005
Expt	Exports of goods and services (constant 2000 US\$)	WDI (2006)	1960-2005
Imp	Imports of goods and services (constant 2000 US\$)	WDI (2006)	1960-2005
Trade	(Exports+Imports)/GDP	WDI (2006)	1960-2005
Debt	Central Government's Debt over GDP in percent	JP (2006)	1970-2005
GDPVar	Conditional Standard Deviation of real GDP from a GARCH (1,1) model	Author's Calculations	1960-2005
RealERVar	Conditional Standard Deviation of Real Exchange Rate from a GARCH (1,1) model	Author's Calculations	1960-2005
Displnc	Real Households' Disposable Income (constant 2000 US\$)	OECD (2007) ECLAC (2006)	1970-2005
PrivatNo	Number of Privatisations	Various <sup>1</sup>	1960-2005
YR	Dummy Variable: Continuous number of years since introduction of reforms	Various <sup>2</sup>	1960-2005

<sup>1</sup> FDI.net, World Bank's Privatization Database, Privatizationbarometer.net.

<sup>2</sup> See Table 1 for a detailed report.

TABLE 3: Descriptive Statistics for Variables used in model's estimation

<i>Variable</i>	<i>Mean</i>	<i>Median</i>	<i>Maximum</i>	<i>Minimum</i>	<i>St.Dev.</i>	<i>Observ.</i>
GDPPC	8303.56	3999.99	37574.10	72.33	8825.53	1169
KPC	1643.79	742.40	8118.51	7.60	1865.19	988
CPC	5216.16	2717.47	25136.95	52.31	5343.67	1007
RealInt	6.87	6.18	88.11	-97.81	35.30	621
DomCred	50.16	32.76	260.39	1.11	43.14	999
Liq	0.48	0.40	2.56	0.05	0.33	882
AgeDep	0.64	0.59	1.05	0.36	0.17	1334
CPI	45.63	33.48	231.60	0.00	43.89	1098
SMCap	0.51	0.23	5.28	0.00	0.70	442
SMTrade	0.30	0.05	3.26	0.00	0.55	463
SMTurn	0.42	0.32	3.29	0.00	0.44	432
SMInd	2096.61	244.85	164243.50	0.00	7960.51	746
Trade	0.56	0.41	4.97	0.06	0.56	1003
Year	2.266	0	46	0	6.008	1334
GDPVar	0.00	0.00	0.09	0.00	0.00	1111
RERVar	2.12	0.04	43.98	0.00	3.50	943
Displnc	0.007	0.000	0.267	0.000	0.035	457
Debt	52.35	39.69	447.10	6.40	52.36	525
PrivatNo	15.67	3.00	1136.00	0.00	76.49	257
Pop	58.38	10.69	1315.00	1.13	191.06	1334

TABLE 4: Unit Root Tests

<i>Variable</i>	<i>Levels</i>				<i>1st Difference</i>			
	<i>LLC</i> <sup>3</sup>	<i>Prob.</i>	<i>IPS</i> <sup>4</sup> <i>ADF</i> <sup>5</sup>	<i>Prob.</i>	<i>LLC</i>	<i>Prob</i>	<i>IPS</i>	<i>Prob</i>
LnGDPPC	-2.716	0.003	73.154	0.042	-15.276	0.000	441.811	0.000
LnKPC	-0.335	0.369	60.597	0.145	-18.653	0.000	507.468	0.000
LnCPC	-2.883	0.002	63.093	0.101	-5.226	0.000	357.917	0.000
RealInt/100	-1.727	0.042	177.959	0.000	-19.637	0.000	389.485	0.000
LnDomCred	2.561	0.995	68.670	0.061	-12.408	0.000	489.259	0.000
LnAgeDep	1.933	0.973	43.304	0.851	-2.012	0.022	114.342	0.000
LnLiq	-1.848	0.032	90.094	0.001	-30.207	0.000	557.339	0.000
DLnCPI	-6.733	0.000	-6.733	0.000	-44.885	0.000	562.060	0.000
LnSMCap	-3.136	0.001	50.609	0.033	-5.917	0.000	107.743	0.000
LnSMTrade	-2.717	0.003	63.300	0.018	-10.905	0.000	206.370	0.000
LnSMInd	2.204	0.986	24.311	0.959	-15.668	0.000	376.414	0.000
LnTrade	3.265	1.000	12.714	1.000	-21.003	0.000	490.970	0.000
GDPVar	-6.466	0.000	254.868	0.000	-28.397	0.000	698.027	0.000
RERVar	-13.587	0.000	216.702	0.000	-29.948	0.000	673.377	0.000
LnDisplnc	-7.065	0.000	70.636	0.004	-9.488	0.000	153.882	0.000
LnDebt	-2.147	0.016	50.159	0.242	-10.193	0.000	190.343	0.000
LnPrivatNo	-3.582	0.000	40.185	0.020	-12.981	0.000	114.923	0.000

Note: The lags are selected by using the Schwartz criteria. Both LLC and IPS tests are for the null hypothesis of panel unit root.

<sup>3</sup> Levin, Lin and Chu (2002).

<sup>4</sup> Im, Pesaran and Shin (1997, 2003).

TABLE 5: Effects of Pension Reforms on GDP per capita

<i>Variables</i>	<i>Countries</i>		
	<i>All</i>	<i>Indust.</i>	<i>EME's</i>
RealInt(-1)/100	-0.107*** (-2.478)	-0.526*** (-2.950)	-0.092* (-1.788)
lnDomCred(-1)	0.017 (1.056)	0.03*** (2.439)	0.011 (0.474)
lnLiq(-1)	-0.004 (-0.170)	0.009 (0.504)	-0.042 (-1.052)
lnAgeDep(-1)	0.14 (0.615)	-1.895*** (-9.216)	1.058*** (3.459)
$\Delta$ lnCPI(-1)	-0.013 (-0.876)	0.3 (1.265)	0.011 (0.539)
lnSMCap(-1))	-0.012 (-1.054)	-0.024 (-1.146)	-0.026* (-1.963)
lnSMTrade(-1))	0.019*** (3.763)	-0.005 (-0.400)	0.019*** (3.453)
lnTrade(-1)	0.287*** (6.742)	0.306 (1.601)	0.335*** (6.802)
YR	-0.01** (-1.970)	0.024** (2.605)	-0.003 (-0.388)
YR <sup>2</sup>	0.0007*** (3.097)	-0.001* (-1.945)	-0.002** (-2.053)
YR <sup>3</sup>	-0.00001*** (-3.340)	0.00001** (2.052)	0.00006*** (2.771)
<b>Tests</b>			
Cross Section F	1080.518	486.975	1209.017
(p-value)	(0.00)	(0.00)	(0.00)
Period F	6.484	3.782	6.124
(p-value)	(0.00)	(0.00)	(0.00)
Hausman $\chi^2$	100.534	NA <sup>6</sup>	39.496
(p-value)	(0.00)		(0.00)
Sample Adjusted	1979-2005	1990-2005	1979-2005
No of Countries	22	7	15
Observations	275	102	173
Adjusted R <sup>2</sup>	0.998	0.99	0.997

Note: The dependent variable is the Log of GDP per capita. All regressions include country specific and period specific fixed effects. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

<sup>6</sup> Random Effects estimation is not possible because the number of cross sections is smaller than the number of coefficients to be estimated.

TABLE 6: Effects of Pension Reforms on GDP per capita Growth

Variables	OLS FE	GMM		
	Default	Default	Lag Dep. Var.	No St. Mark.
$\Delta \text{RealInt}(-1)/100$	-0.053 (-1.563)	0.068 (0.737)	-0.092 (-1.530)	0.013 (0.231)
$\Delta \ln \text{DomCred}(-1)$	-0.035* (-1.706)	-0.037 (-0.485)	-0.028 (-0.717)	0.112** (2.150)
$\Delta \ln \text{Liq}(-1)$	0.012 (0.441)	0.074 (0.727)	-0.005 (-0.079)	-0.164*** (-2.610)
$\Delta \ln \text{AgeDep}(-1)$	0.279 (0.579)	-0.243 (-0.980)	-0.149 (-1.190)	-0.431*** (-2.190)
$\Delta \ln \text{CPI}(-1)$	-0.014 (-1.508)	0.114** (2.190)	0.078*** (2.780)	0.02 (0.507)
$\Delta \ln \text{SMTrade}(-1)$	0.006** (2.154)	0.041*** (2.780)	0.027*** (3.090)	
$\Delta \ln \text{Trade}(-1)$	0.099 (1.608)	0.184** (2.050)	0.132** (2.350)	0.492*** (5.620)
$\Delta \text{GDPPC}(-1)$			0.52*** (4.710)	
$\Delta \text{YR}$	0.027*** (3.103)	0.011* (1.760)	0.007 (2.02)	0.00001 (0.014)
$\Delta \text{YR}^2$	0.001 (1.043)	-0.000002 (-0.302)	-0.0002 (-0.823)	0.0004 (0.44)
$\Delta \text{YR}^3$	0.000011** (2.315)	0.000005 (0.530)	0.000003 (0.77)	-0.00001 (-0.298)
<b>Tests</b>				
Period F	3.141			
(p-value)	(0.00)			
Cross Section F	2.168			
(p-value)	(0.003)			
Hausman $\chi^2$	34.409			
(p-value)	(0.00)			
Sargan		6.479	7.659	14.73
(p-value)		(0.423)	(0.999)	(0.999)
AR(2)		1.473	1.468	-0.557
(p-value)		(0.423)	(0.142)	(0.577)
Sample Adjust.	1979-2005	1979-2005	1979-2005	1964-2005
No of Countries	24	24	24	26
Observations	253	253	253	487
Adjusted R <sup>2</sup>	0.303			

Note: The dependent variable is the growth rate of GDP per capita. The 1st column reports the estimates of OLS FE in differences. The 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> columns show the results of GMM Arellano and Bond (1988) estimations. The 1<sup>st</sup> and 2<sup>nd</sup> columns test the benchmark specification. The 3<sup>rd</sup> column includes the lagged dependent variable while the forth column abstracts from stock market variables. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

TABLE 7: Effects of Pension Reforms on Capital per capita

<i>Variables</i>	Countries		
	<i>All</i>	<i>Indust.</i>	<i>EME's</i>
lnSMTrade(-1))	0.093*** (6.309)	-0.0001 (-0.006)	0.09*** (5.373)
lnTrade(-1)	0.774*** (5.425)	0.02 (0.104)	0.848*** (5.025)
GDPVar(-1) <sup>1/2</sup>	-4.26*** (-3.187)	-4.139 (-1.468)	-4.18*** (-2.960)
RealERVar(-1) <sup>1/2</sup>	-0.024 (-0.572)	0.003 (0.116)	-0.031 (-0.431)
RealInt(-1)/100	-0.135 (-1.018)	-0.87** (-2.078)	-0.152 (-0.973)
YR	0.002 (0.109)	0.016 (1.438)	0.025 (1.001)
YR <sup>2</sup>	0.002*** (4.146)	0.001** (2.394)	-0.002 (-1.037)
YR <sup>3</sup>	-0.000032*** (-4.724)	-0.00002*** (-3.372)	0.00012* (1.757)
<b>Tests</b>			
Period F	4.258	4.304	2.826
(p-value)	(0.00)	(0.00)	(0.00)
Cross Section F	255.286	147.393	159.222
(p-value)	(0.00)	(0.00)	(0.00)
Hausman $\chi^2$	38.109	NA <sup>7</sup>	23.86
(p-value)	(0.00)		(0.002)
Sample Adjusted	1978-2005	1989-2004	1978-2005
No of Countries	23	7	16
Observations	303	104	199
Adjusted R <sup>2</sup>	0.984	0.954	0.97

Note: The dependent variable is the Log of gross Capital per capita. All regressions include country specific and period specific fixed effects. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

<sup>7</sup> Random Effects estimation is not possible because the number of cross sections is smaller than the number of coefficients to be estimated.

TABLE 8: Effects of Pension Reforms on Capital per capita Growth (Investment)

Variables	OLS FE	GMM		
	Default	Default	Lag Dep. Var.	No St. Mark.
$\Delta \ln \text{SMTrade}(-1)$	-0.009 (-0.867)	0.135** (2.810)	0.095** (2.470)	
$\Delta \ln \text{Trade}(-1)$	0.326* (1.823)	0.223 (0.875)	0.087 (0.361)	1.077*** (4.870)
$\Delta \text{GDPVar}(-1)^{1/2}$	-0.987 (-1.320)	-3.455 (-1.240)	-3.918 (-1.380)	-0.119 (-0.073)
$\Delta \text{RealERVar}(-1)^{1/2}$	0.032 (1.06)	-0.009 (-0.414)	-0.019 (-0.936)	-0.048 (-1.070)
$\Delta \text{RealInt}(-1)/100$	-0.265** (-2.388)	-0.361 (-1.290)	-0.256 (-1.150)	-0.35*** (-2.850)
$\Delta \ln \text{Inv}(-1)$			0.321*** (3.640)	
$\Delta \text{YR}$	0.024 (0.809)	-0.015 (-0.854)	-0.017 (-1.140)	-0.023 (-0.986)
$\Delta \text{YR}^2$	0.005** (1.920)	0.002 (0.15)	0.002** (2.040)	0.002 (1.09)
$\Delta \text{YR}^3$	-0.000003 (-0.107)	-0.000003 (-1.650)	-0.0000035** (-2.140)	0.000 (1.101)
<b>Tests</b>				
Cross Section F	1.281			
(p-value)	(0.186)			
Period F	3.617			
(p-value)	(0.00)			
Hausman $\chi^2$	4.529			
(p-value)	(0.807)			
Sargan		14.93	14.43	21.79
(p-value)		(1.00)	(1.00)	(1.00)
AR(2)		0.648	-0.191	-2.033
(p-value)		(0.517)	(0.849)	(0.042)
Sample Adjust.	1978-2005	1981-2005	1981-2005	1971-2005
No of Countries	23	23	22	25
Observations	282	231	231	423
Adjusted R <sup>2</sup>	0.215			

Note: The dependent variable is the growth rate of capital per capita. The 1st column reports the estimates of OLS FE in differences. The 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> columns show the results of GMM Arellano and Bond (1988) estimations. The 1<sup>st</sup> and 2<sup>nd</sup> columns test the benchmark specification. The 3<sup>rd</sup> column includes the lagged dependent variable while the forth column abstracts from stock market variables. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.



TABLE 9: Effects of Pension Reforms on Consumption per capita

<b>Variables</b>	<b>Countries</b>		
	<b>All</b>	<b>Indust.</b>	<b>EME's</b>
RealInt(-1)/100	-0.136** (-1.938)	0.187 (0.83)	-0.171*** (-2.927)
lnDisplnc(-1)	0.05** (2.223)	0.00 (0.017)	0.054 (1.388)
lnLiq(-1)	0.033 (1.325)	0.108*** (4.736)	-0.154*** (-3.555)
lnSMInd(-1)	0.026** (2.077)	0.013 (0.704)	0.0125 (0.626)
YR	0.006** (2.097)	0.014*** (5.642)	0.007 (0.537)
YR <sup>2</sup>	0.00029 (1.357)	-0.0001 (-0.51)	-0.001 (-0.869)
YR <sup>3</sup>	-0.0000069** (-2.032)	-0.000001 (-0.341)	0.00004 (1.218)
<b>Tests</b>			
Period F	4.803	6.738	1.088
(p-value)	(0.00)	(0.00)	(0.378)
Cross Section F	943.186	92.749	472.259
(p-value)	(0.00)	(0.00)	(0.00)
Hausman $\chi^2$	57.965	NA <sup>8</sup>	108.69
(p-value)	(0.00)		(0.00)
Sample			
Adjusted	1971-2005	1971-2004	1978-2005
No of Countries	18	7	11
Observations	311	187	124
Adjusted R <sup>2</sup>	0.994	0.982	0.97

Note: The dependent variable is the Log of Consumption per capita. All regressions include country specific and period specific fixed effects. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

<sup>8</sup> Random Effects estimation is not possible because the number of cross sections is smaller than the number of coefficients to be estimated.

TABLE 10: Effects of Pension Reforms on Consumption per capita Growth

<b>Variables</b>	<b>OLS FE</b>	<b>GMM</b>	
	<b>Default</b>	<b>Default</b>	<b>Lag Dep. Var.</b>
$\Delta \ln \text{RealInt}$	-0.112*** (-2.995)	0.149 (1.41)	0.033 (0.583)
$\Delta \ln \text{Displnc}$	0.062*** (3.116)	0.167*** (4.460)	0.064*** (2.810)
$\Delta \ln \text{Liq}$	0.023 (1.148)	0.113 (1.540)	0.02 (0.562)
$\Delta \ln \text{SMInd}$	0.034*** (3.090)	0.042*** (2.890)	0.036*** (3.710)
$\Delta \ln \text{CPC}(-1)$			0.557*** (6.080)
$\Delta \text{YR}$	0.016** (2.480)	0.015** (1.900)	0.005 (1.40)
$\Delta \text{YR}^2$	-2.4E-05 (-0.067)	-2.4E-04 (-0.460)	-6.4E-05 (-0.308)
$\Delta \text{YR}^3$	-2.5E-06 (-0.481)	-5.40E-06 (-0.70)	1.4E-06 (0.525)
<b>Tests</b>			
Cross Section F	2.637		
(p-value)	(0.00)		
Period F	1.143		
(p-value)	(0.00)		
Hausman $\chi^2$	17.531		
(p-value)	(0.014)		
Sargan		12.77	10.965
(p-value)		(0.99)	(0.99)
AR(2)		1.094	0.608
(p-value)		(0.274)	(0.543)
Sample Adjust.	1972-2005	1973-2005	1973-2005
No of Countries	18	18	18
Observations	292	273	273

Note: The dependent variable is the growth rate of Consumption per capita. The 1st column reports the estimates of OLS FE in differences. The 2<sup>nd</sup> and 3<sup>rd</sup> columns show the results of GMM Arellano and Bond (1988) estimations. The 1<sup>st</sup> and 2<sup>nd</sup> columns test the benchmark specification. The 3<sup>rd</sup> column includes the lagged dependent variable. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

TABLE 11: Interactions

<i>Variables</i>	<i>Eq.1</i>	<i>Eq.2</i>	<i>Eq.3</i>	<i>Eq.4</i>	<i>Eq.5</i>
RealInt(-1)/100	-0.178*** (-3.922)	-0.119** (-2.854)	-0.173*** (-4.091)	-0.103** (-2.781)	-0.089* (-1.737)
LnDomCred(-1)	0.009 (0.772)	0.011 (0.7666)	0.028** (2.064)	0.023 (1.4398)	0.032 (1.149)
LnLiq(-1)	0.021 (0.942)	0.031 (1.283)	0.008 (0.414)	-0.037 (-1.496)	-0.032 (-1.108)
LnAgeDep(-1)	0.070 (0.412)	0.255 (1.479)	-0.146 (-0.833)	0.031 (0.146)	0.963** (2.876)
ΔLnCPI(-1)	-0.002 (-0.108)	0.017 (1.376)	-0.034** (-2.420)	-0.035** (-2.162)	-0.062 (-1.600)
LnTrade(-1)	0.210*** (5.386)	0.297*** (7.321)	0.261*** (7.672)	0.317*** (8.424)	0.431*** (8.167)
LnSMCap(-1)	0.009 (1.039)	0.000 (0.042)	0.025** (3.2372)	0.011 (1.204)	0.015 (1.005)
YR	-0.074*** (-4.644)	-0.041*** (-2.947)	-0.033** (-2.336)	-0.003 (-0.561)	-0.032*** (-3.986)
YR <sup>2</sup>	0.005** (2.143)	0.004*** (3.354)	-0.002 (-0.766)	0.001** (2.391)	0.002*** (5.594)
YR <sup>3</sup>	0.000006 (0.0770)	0.000*** (2.625)	0.000** (2.4090)	0.000*** (3.102)	0.000*** (5.965)
LnDebt(-1)	-0.065*** (-4.423)	-0.079*** (-5.238)			
LnDebt(-1)*YR	0.007* (1.853)	0.011*** (2.868)			
LnDebt(-1)*YR <sup>2</sup>	-0.001** (-2.036)	-0.001*** (-3.233)			
LnDebt(-1)*YR <sup>3</sup>	0.000 (1.621)	0.000** (2.497)			
LnAgeDep(-1)*YR	-0.081*** (-4.226)		-0.065*** (-3.315)		
LnAgeDep(-1)*YR <sup>2</sup>	0.003 (1.225)		-0.002 (-0.688)		
LnAgeDep(-1)*YR <sup>3</sup>	0.0001 (0.589)		0.0003** (2.415)		
LnSMCap(-1)*YR	-0.006** (-2.583)			-0.003 (-1.200)	
LnSMCap(-1)*YR <sup>2</sup>	0.001*** (2.8)			0.001*** (2.621)	
LnSMCap(-1)*YR <sup>3</sup>	-0.00001** (-2.617)			-0.00001*** (-2.869)	
LnPrivatNo(-1)					-0.009 (-1.086)
LnPrivatNo(-1)*YR					0.006* (1.825)
LnPrivatNo(-1)*YR <sup>2</sup>					-0.0004* (-1.774)
LnPrivatNo(-1)*YR <sup>3</sup>					0.00001* (1.722)
<b>Tests</b>					
<i>Period F</i>	2080.617	1883.942	1711.846	1335.464	783.207
(p-value)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
<i>Cross Section F</i>	3.332	3.926	7.137	6.912	3.055
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
<i>Hausman <math>\chi^2</math></i>	37619.446	49.081	53.307	43.938	103.538
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<i>Sample Adjusted</i>	1989 2005	1989 2005	1979 2005	1979 2005	1989 2005
<i>No of Countries</i>	21	21	22	22	16
<i>Observations</i>	256	256	284	284	136
<i>Adjusted R<sup>2</sup></i>	0.999	0.999	0.998	0.998	0.998

TABLE 12: Factors that influence the impact of pension reforms (Cross Sectional Analysis)

<i>Variables</i>	LHS: Impact PR 5yrs Average				LHS: Impact PR 5 yrs Sum			
	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8
<b>P.Debt growth</b>	-0.005** (-2.047)	-0.004* (-1.818)	-0.004* (-1.842)	-0.004 (-1.619)	-0.024** (-2.163)	-0.023* (-1.956)	-0.023* (-2.000)	-0.021 (-1.740)
<b>LnPrivatNo</b>		0.004 (0.462)	0.005 (0.490)	0.010 (1.527)		0.015 (0.334)	0.017 (0.374)	0.046 (1.443)
<b>LnAgeDep</b>			-0.046 (-0.616)	-0.175** (-2.591)			-0.268 (-0.764)	-0.888** (-2.691)
<b>LnSMCap</b>				-0.027*** (-3.409)				-0.134*** (-3.432)
<b>Tests</b>								
<b>White Heter. Test</b> (p-value)	4.831 (0.009)	2.429 (0.076)	1.273 (0.335)	3.419 (0.039)	5.370 (0.006)	2.875 (0.045)	1.302 (0.323)	2.998 (0.057)
<b>No of Observ.</b>	22	22	22	20	22	22	22	20
<b>Adjusted R<sup>2</sup></b>	0.259	0.228	0.204	0.427	0.293	0.260	0.245	0.454

Note: The dependent variable “Impact” is derived using the following expression:  $Impact = \hat{\alpha}Yr + \hat{\beta}Yr^2 + \hat{\gamma}Yr^3$ . The coefficients  $\alpha, \beta, \gamma$  are obtained by estimating equation (3) separately for each country in our panel. The estimates of equations 1-4 are based on a five years average of impact while for the estimates in equations 5-8 we use the five years sum. The equations are estimated using weighted LS. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic based on White Heteroscedasticity consistent standard errors is reported in the parentheses.

TABLE 13: Fixed Effects Estimations for all countries except Netherlands

GDPPC (1)		KPC (2)		CPC (3)	
<i>Variables</i>		<i>Variables</i>		<i>Variables</i>	
RealInt(-1)/100	-0.108*** (-2.502)	RealInt(-1)/100	-0.124 (-0.938)	RealInt(-1)/100	-0.150** (-2.008)
InDomCred(-1)	0.021 (0.756)	GDPVar(-1) <sup>1/2</sup>	-4.276*** (-3.179)	InDisplnc(-1)	0.020 (0.896)
InLiq(-1)	0.015 (0.510)	RealERVar(-1) <sup>1/2</sup>	-0.015 (-0.373)	InLiq(-1)	0.080*** (3.331)
InAgeDep(-1)	0.194 (0.842)	InSMTrade(-1))	0.094*** (6.342)	InSMInd(-1)	0.028** (2.161)
ΔlnCPI(-1)	-0.009 (-0.609)	InTrade(-1)	0.767*** (5.396)		
InSMCap(-1))	-0.012 (-1.106)				
InSMTrade(-1)	0.019*** (3.784)				
InTrade(-1)	0.295*** (6.790)				
YR	-0.006* (-1.576)	YR	0.010 (0.983)	YR	0.005** (2.243)
YR <sup>2</sup>	0.0004*** (3.185)	YR <sup>2</sup>	0.0010*** (4.006)	YR <sup>2</sup>	0.0004*** (-4.365)
<i>Tests</i>					
Cross Section F	1081.029		255.378		4.803
(p-value)	(0.00)		(0.00)		(0.00)
Period F	6.449		4.195		943.186
(p-value)	(0.00)		(0.00)		(0.00)
Hausman $\chi^2$	100.738		38.196		57.965
(p-value)	(0.00)		(0.00)		(0.00)
Sample					
Adjusted	1979-2005		1978-2005		1971-2005
No of Countries	21		22		18
Observations	261		287		311
Adjusted R <sup>2</sup>	0.998		0.983		0.994

Note: The dependent variable in (1) is the Log of GDP per capita, in (2) is the Log of Capital per capita and in (3) the Log of Consumption per capita. We follow the same specification as in Tables 5,7,9 but we use a second order polynomial of YR and we do not include Netherlands in our panel. Netherlands may be an outlier since it gives a small but significant coefficient in YR<sup>3</sup>. \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

TABLE 14a: Fixed Effects Estimations with Country Specific Time Effects

GDPPC		GDPPC growth		KPC		KPC growth	
(1)		(2)		(3)		(4)	
<b>Variables</b>		<b>Variables</b>		<b>Variables</b>		<b>Variables</b>	
RealInt(-1)/100	-0.201*** (-2.411)	ΔRIInt(-1)/100	-0.116*** (-2.390)	InSMTr(-1)	0.117*** (6.858)	ΔInSMTr(-1)	0.000 (-0.006)
InDomCred(-1)	-0.010 (-0.507)	ΔInDCred(-1)	-0.034** (-1.919)	InTrade(-1)	0.376*** (2.558)	ΔInTrade(-1)	0.581*** (2.697)
InLiq(-1)	0.038 (1.224)	ΔInLiq(-1)	0.002 (0.070)	GDPVar(-1) <sup>1/2</sup>	-4.230*** (-2.968)	ΔGDPVar(-1) <sup>1/2</sup>	-2.305** (-1.676)
InAgeDep(-1)	-0.243 (-1.243)	ΔInAgeDep(-1)	0.138 (0.212)	RERVar(-1) <sup>1/2</sup>	-0.052 (-1.009)	RERVar(-1) <sup>1/2</sup>	0.065* (1.304)
ΔInCPI(-1)	-0.028* (-1.501)	ΔInCPI(-1)	-0.019** (-2.182)	RInt(-1)/100	-0.338* (-1.577)	ΔRIInt(-1)/100	-0.351** (-1.640)
InSMCap(-1))	0.236*** (3.826)	ΔInSMTr(-1)	0.009*** (2.486)				
InSMTrade(-1))	0.026*** (3.708)	ΔInTrade(-1)	0.092* (1.604)				
InTrade(-1)	-0.008 (-0.464)						
YR	0.001 (0.171)	ΔYR	0.016** (1.745)	YR	-0.014 (-1.258)	ΔYR	-0.040 (-1.012)
YR <sup>2</sup>	0.001*** (3.813)	ΔYR <sup>2</sup>	0.0003 (0.588)	YR <sup>2</sup>	0.003*** (4.092)	ΔYR <sup>2</sup>	0.002 (0.499)
YR <sup>3</sup>	0.0002*** (-4.084)	ΔYR <sup>3</sup>	0.00001** (-1.923)	YR <sup>3</sup>	0.00005*** (-4.677)	ΔYR <sup>3</sup>	0.000 (-0.569)
<b>Tests</b>							
Cross Section F	582.17		2.384		188.83		1.046
(p-value)	(0.000)		(0.001)		(0.000)		(0.410)
Country Spec.							
Period. F	0.83		1.262		1.29		1.342
(p-value)	(0.79)		(0.136)		(0.101)		(0.078)
Hausman $\chi^2$							
Sample Adjusted	1979-2005		1979-2005		1978-2005		1990-2005
No of Countries	22		24		23		23
Observations	275		253		303		260
Adjusted R <sup>2</sup>			0.177		0.981		0.161

TABLE 14b: Fixed Effects Estimations with Country Specific Time Effects

CPC		CPC growth	
(5)		(6)	
<i>Variables</i>		<i>Variables</i>	
RealInt(-1)/100	0.073 (0.793)	$\Delta$ RealInt(-1)/100	0.171*** (-3.071)
lnDisplnc(-1)	0.102*** (3.257)	$\Delta$ lnDisplnc(-1)	0.053** (2.624)
lnLiq(-1)	0.089*** (2.634)	$\Delta$ lnLiq(-1)	0.026 (1.398)
lnSMInd(-1)	0.078*** (5.878)	$\Delta$ lnSMInd(-1)	0.03*** (3.645)
YR	0.016*** (3.927)	$\Delta$ YR	(0.014)** (2.142)
YR <sup>2</sup>	0.00010 (0.176)	$\Delta$ YR <sup>2</sup>	-0.0003 (-0.873)
YR <sup>3</sup>	-0.0000 (-0.918)	$\Delta$ YR <sup>3</sup>	0.00 (0.561)
<b>Tests</b>			
Cross Section F	564.992		2.081
(p-value)	(0.00)		(0.001)
Country Spec.			
Period F	1.1948		1.5362
(p-value)	(0.185)		(0.017)
Hausman $\chi^2$			
Sample Adjusted	1971-2005		1972-2005
No of Countries	18		18
Observations	311		292
Adjusted R <sup>2</sup>	0.992		0.338

Note: Tables 14a and 14b present the results of the fixed effects regression by using the same specifications as in Tables 5-10. However in this table we use country specific period fixed effects instead of year specific fixed effects we used for the results in Tables 5-10. The dependent variables are: the Log of GDP per capita in (1), the Log of the GDP per capita growth in (2), the Log of capital per capita in (3), the Log of capital per capita growth in (4), the Log of consumption per capita in (5) and the Log of consumption per capita growth in (6). \* = significant at 10% level, \*\* = significant at 5% level, and \*\*\* = significant at 1% level. The t statistic is reported in the parentheses.

Figure 1: Relationship between Output per capita and Pension Reform.

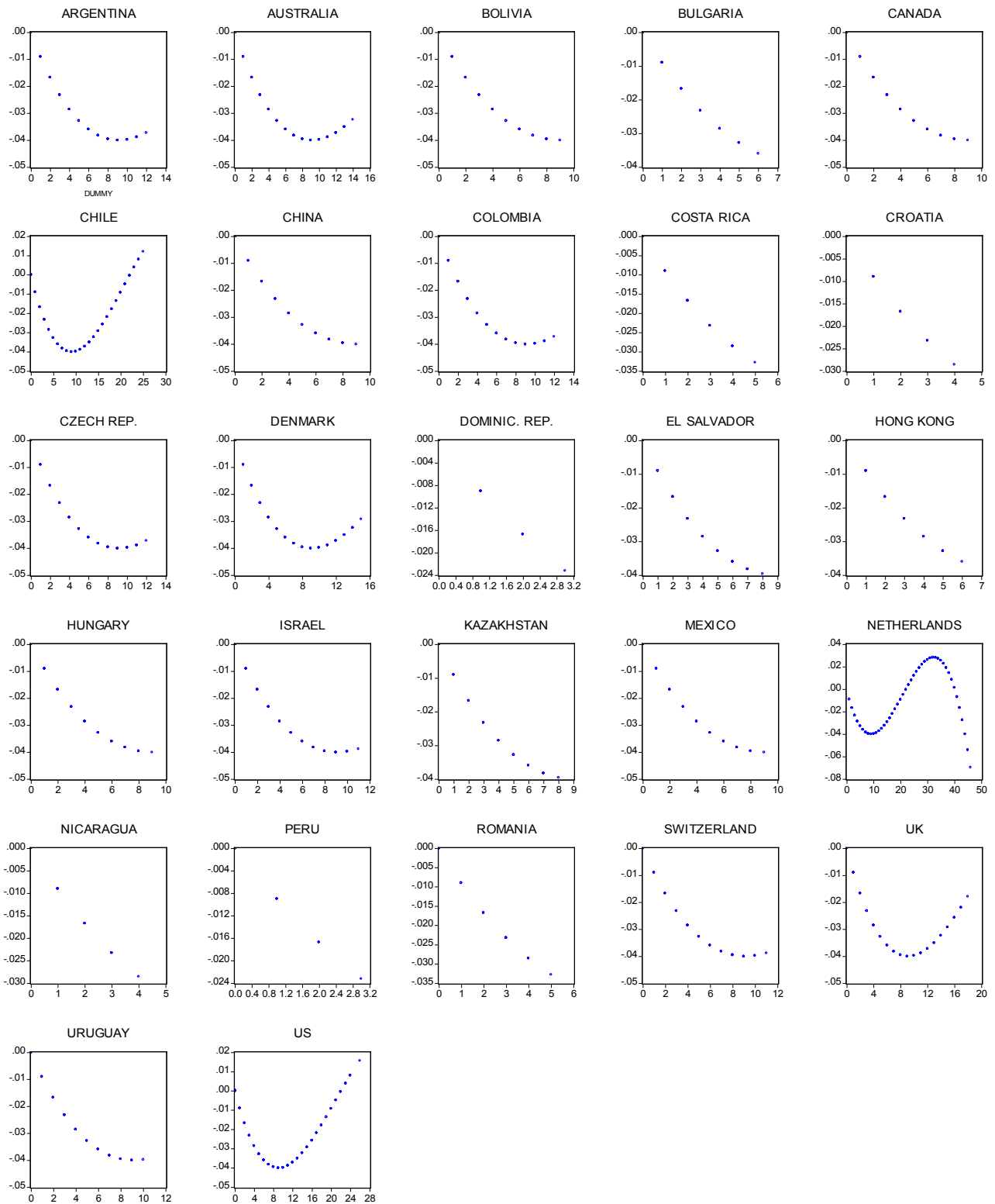




Figure 2: Relationship between Capital Stock (per capita) and Pension Reform

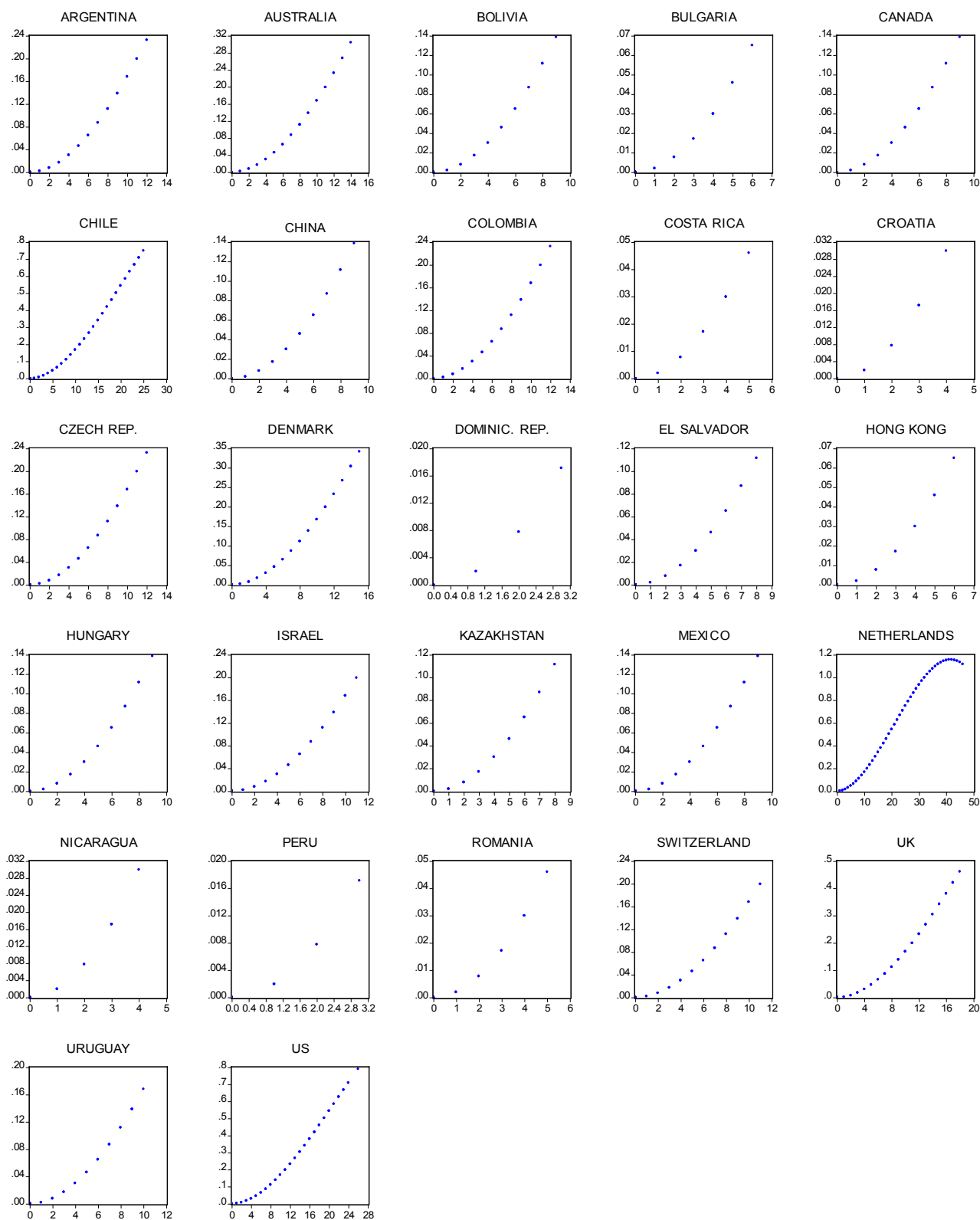
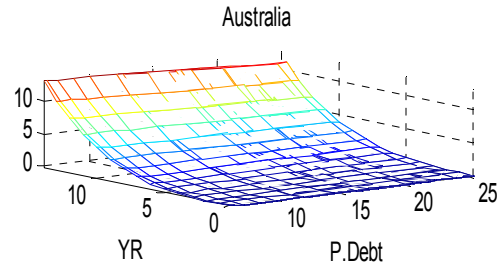
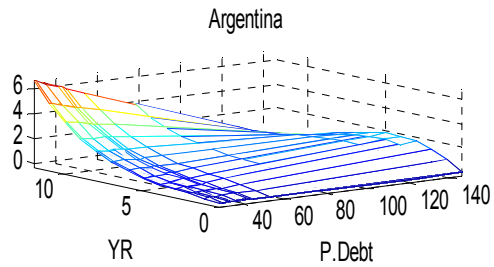
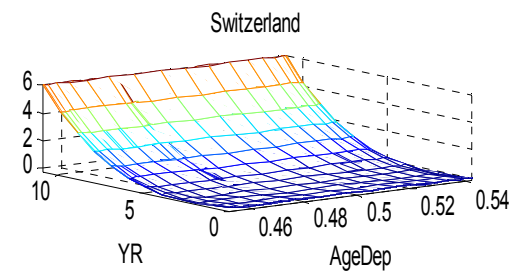
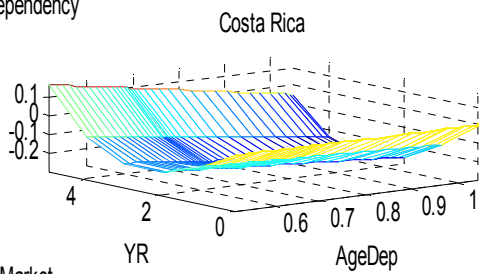


Figure3: Factors that affect Pension Reforms

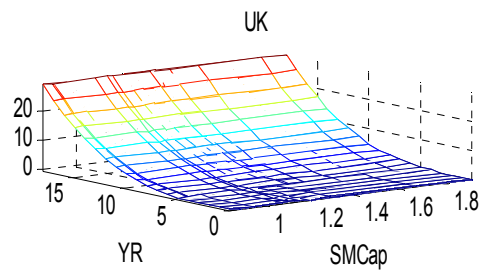
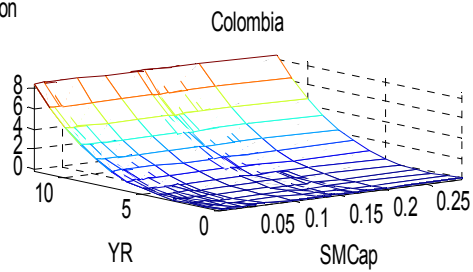
a) Public Debt



b) Age Dependency



c) Stock Market Capitalisation



d) No of Privatisations

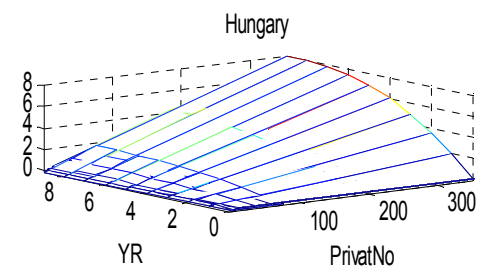
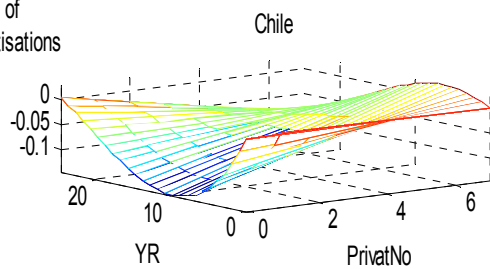


Figure 4: Stock Market Capitalisation (3<sup>rd</sup> column)

